

TSMC99-646BCC

PLEASE AMEND THE CLAIMS AS FOLLOWS:

Claims 1 - 19 (cancelled)

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Claim 20. (currently amended) A metal structure on a semiconductor substrate, comprising:

a via hole in an insulator layer exposing a portion of an underlying lower level metal interconnect structure;

a recessed metal plug structure located in a bottom portion of said via hole, with said recessed metal plug structure overlying and contacting the portion of said lower
5 level metal interconnect structure exposed in said via hole; and

5 said metal structure comprised with a metal segment located only on a first portion
located of a smooth top surface of said insulator layer with an absence of said metal
segment on a bare, second portion of said insulator layer, and with said metal structure
comprised with a metal ring structure ~~second portion attached to said first portion of~~
~~said metal structure attached to said metal segment and located on exposed sides of top~~
portion of said via hole, wherein said second portion is a metal ring structure, and
wherein said metal ring structure comprised of metal spacers located on all the sides
of a top portion of said via hole, traversing all exposed sides of said top portion of said
via hole from the top perimeter of said via hole to a top surface of said recessed metal
10 plug structure, and with said metal spacers terminating and converging at center of top
surface of said recessed plug structure, and located overlying only portions of a top
surface of said recessed metal plug structure located at the bottom of said via hole,
resulting in a discontinuity between said metal spacers at bottom of said via hole,
wherein the thickness of said metal ring structure on sides of top portion of said via
15 hole is greater than the thickness of said metal ring structure located on center portion
of said metal plug structure.

Claim 21. (previously amended) The metal structure of claim 20, wherein said lower level metal interconnect structure is comprised of a composite metal structure, featuring an aluminum, or an aluminum based layer, at a thickness between about 2000 to 20000 Angstroms, with an underlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms, and an overlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms.

Claim 22. (previously amended) The metal structure of claim 20, wherein said via hole is comprised with a diameter between about 0.10 to 1.0 um.

Claim 23. (previously amended) The metal structure of claim 20, wherein said recessed metal plug structure, is comprised of tungsten, with the height of said recessed metal plug structure, located in said bottom portion of said via hole, between about 3000 to 20000 Angstroms.

Claim 24. (previously amended) The metal structure of claim 20, wherein said metal ring structure, attached to said first portion of said metal structure, is comprised of aluminum, or aluminum - copper spacers, located on the sides of said top portion of said via hole.
